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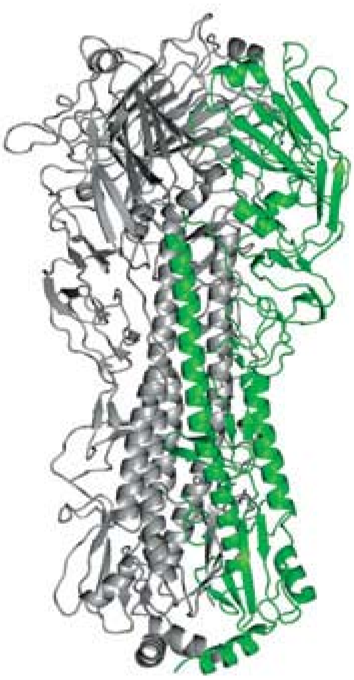
Bird flu protein structure solved



Courtesy of James Stevens

During infection, viruses use hemagglutinin proteins to bind to the cells of hosts. Avian viruses employ a variety of hemagglutinins, numbered H1 through H16. Only H1, H2, and H3 have adapted successfully to the human population, in each case triggering a pandemic. Scripps Research Institute scientists have now determined the structure of an H5 hemagglutinin from a highly pathogenic strain of H5N1 avian influenza virus. In a paper in *Science*, James Stevens, Ian A. Wilson, and colleagues compare the structure of the protein (shown) with hemagglutinins from other influenza viruses carried by birds and humans, including the virus responsible for the deadly 1918 flu epidemic (published online March 16, dx.doi.org/10.1126/science.1124513). The researchers also analyze the protein's binding specificity. Their results reveal one possible route by which the virus could mutate and switch from a preference for binding to receptors on avian cells to receptors on human cells and thus adapt to the human population.

Protein production, one molecule at a time

Two new techniques have been developed to follow the production of single protein molecules in living cells in real time. X. Sunney Xie of Harvard University says his lab's methods will allow scientists to investigate the expression of low-abundance proteins, information that can't be obtained with current genomic and proteomic techniques. In one study, Ji Yu, Jie Xiao, and Xie visualize the production of single molecules of a fluorescent, membrane-targeted fusion protein in cells of living bacteria (*Science* **2006,** *311*, 1600). In the other, Long Cai, Nir Friedman, and Xie demonstrate a microfluidic-based assay that uses β-galactosidase-a standard and highly sensitive cellular reporter of gene expression-to track protein production in living bacterial cells with single-molecule sensitivity (*Nature* **2006,** *440*, 358). Both approaches reveal that protein production occurs in bursts and that the number of molecules in each burst varies, Xie notes. The microfluidic assay also works with yeast and mammalian cells, and because it is easy to scale up, it may pave the way for whole-genome studies of the production of low-abundance proteins such as transcription factors, he adds.

Fuel-cell muscles for RoboRambo

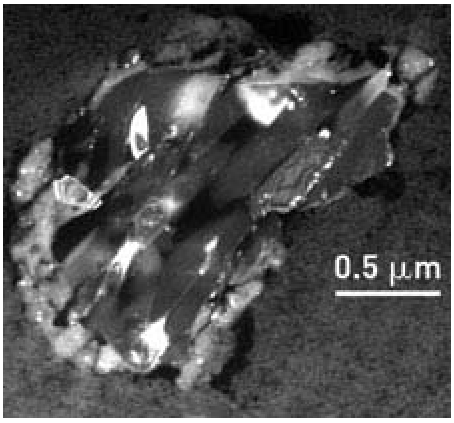
A humanoid robot that fights in front of ordinary soldiers, takes bullets for them, and then downs a shot of diesel fuel to continue the fight is the wish-list item that Ray Baughman of the University of

Texas at Dallas, Richardson, recalls from a 2004 discussion with John Main, a program manager with the Defense Advanced Research Projects Agency. Baughman hasn't delivered the battery-free robowarrior that Main had in mind, but he and 10 colleagues have devised two types of artificial muscles whose flexing components double as part of the fuel cell that powers them (*Science* **2006,** *311*, 1580). In one design, a strip made of platinum-coated carbon nanotubes remains straight until the fuel cell it is part of is switched off. That's when charge quickly builds on the nanotubes, which respond by flexing. The second prototype is based on shape-memory nickel-titanium wires coated with catalytic platinum particles. When the fuel-for example, a vapor of methanol-bathes the wire, a catalytic reaction generates heat, which triggers a reversible shape change in the alloy. In effect, these artificial robotic muscles work by breathing fuel rather than by drawing electricity from batteries.

A better hydrogen-producing catalyst

With an eye toward producing large quantities of hydrogen, scientists have created a new photocatalyst that splits water 10 times more efficiently than previously reported similar photocatalysts. When exposed to visible light, the catalyst-a solid solution of gallium nitride and zinc oxide impregnated with nanoparticles of a mixed oxide of rhodium and chromium-splits water, producing hydrogen gas with a quantum efficiency of 2.5%, according to Kazunari Domen at the University of Tokyo and colleagues (*Nature* **2006,** *440*, 295). The mixed oxide appears to be key; rhodium or chromium oxide alone does not improve the catalyst's activity. The authors report the reaction's efficiency increases with short-wavelength light. The catalyst performed repeated runs for 35 hours without degrading. The authors also say the catalyst could be improved to work well at long wavelengths of light.

A hot start for some comets?



NASA Photo

Some comets may be made up of material ejected from the sun or other stars during the early days of their formation, in contrast to the icy outer solar system origin previously envisioned, scientists announced on March 13. Particles of the comet Wild 2, returned to Earth last January by NASA's *Stardust* spacecraft, contain the iron-magnesium silicate mineral olivine-in particular, a magnesium-rich form known as forsterite (shown in a sample from *Stardust*). Olivine is common in the solar system, but it is believed to be formed at high temperatures near stars. The samples also contain other minerals rich in calcium, aluminum, and titanium that were likely formed at high temperatures. More than 150 researchers worldwide are now studying the tiny comet grains that were captured in aerogel collectors aboard *Stardust*. Scientists hope to determine how much of the comet material came from outside the solar system and how much came from our own solar nebula, said Donald Brownlee, principal investigator for the $200 million *Stardust* mission.

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